Exploring Disaster Risk and Vulnerability in Society

Swimming for pigs: Reframing vulnerability through reflections on culture and space in stories of disaster from a coastal community in Mexico and the Philippines

A Major Portfolio submitted to the Faculty of Environmental Studies
in partial fulfillment of the requirements for the degree of
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Abstract

Critical theory scholars have long framed disaster risk in cultural terms, however, risk management practitioners are still applying a reductionist approach to mapping risk, equating it to the product of hazard, exposure and vulnerability. What is problematic about this approach is that vulnerability encompasses complex social and cultural processes that are scantly captured with current practices. Without better accounting for vulnerability and community resiliencies, risk maps fail as policy and planning instruments; worse, they irresponsibly label communities 'at risk' and are weaponized to dispose people from their land and de-value their place. Community narrated disaster experiences analyzed under assemblage theory framed through a socio-spatial lens reveal findings that transcend the academic-practitioner divide to offer applied recommendations for vulnerability elements that more thoroughly reflect its complexities. Additionally, these findings assert that risk maps and assessments will never completely capture vulnerability due to complexity and continual temporal transformations and should therefore never be use in isolation to make policy and planning decisions.

Foreword

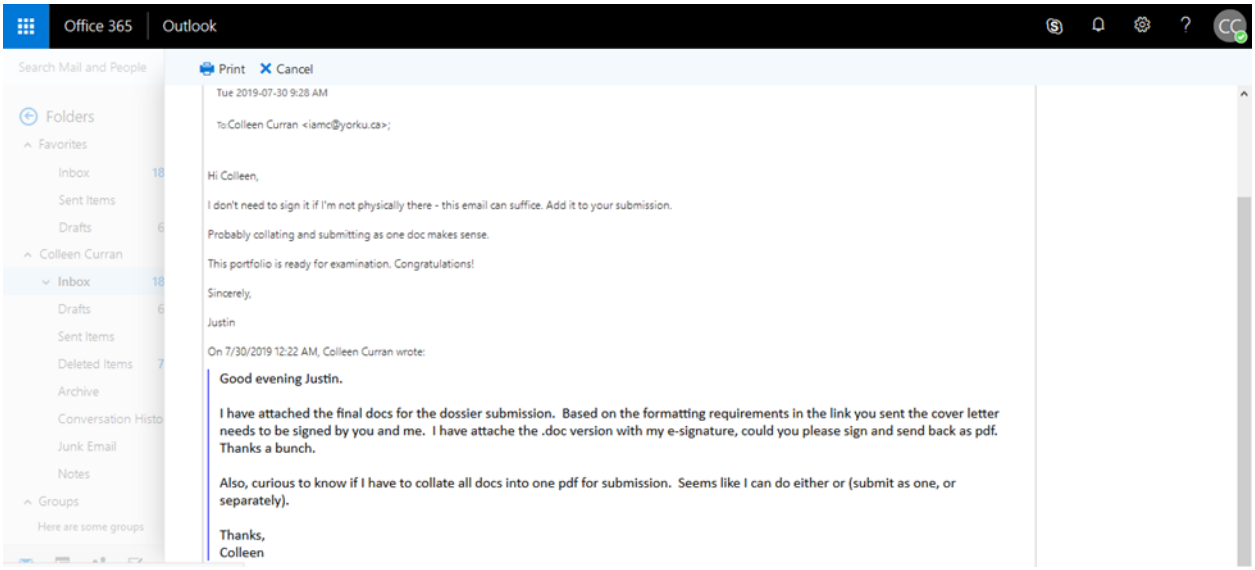
This report is the summation of eight months of research, twelve months of field work and the fulfilment of a long-term goal to attend the Master in Environmental Studies program and critically examine disaster risk. As a disaster risk management practitioner by experience and a geographer by training the work presented in the pages below is more than an academic exercise, it is the product of my personal and professional due diligence to epistemologically explore my field of work. It is a social contract to the people my future work incorporates that recognizes them as highly complex individuals and communities irreducible to units of quantification—in the past I have failed to consider this.

In academic terms the paper highlights my accomplishment in Learning objective 1.3: t*o obtain a comprehensive understanding of the intersectionalities of disaster risk and vulnerability in Mexican and Filipino society*; Learning objective 2.2: t*o gain hands on experience in applying research methodologies in the field and through research*; and Learning objective 3.2: to *develop an implementation methodology and test best practices, applications and concepts for disaster risk reduction in Mexico and the Philippines.* Throughout the paper I applied concepts from learning strategies (course) aimed at Learning objective 1.1*: to obtain a general knowledge of critical theories in development, people and places* and Learning objective 2.1*: to gain a wide breadth of knowledge of research methods used in the social sciences and systems of thought.*

Acknowledgements

Thank you to the numerous people who supported me throughout this project. To Justin Podur, my supervisor who offered me continual support through the entire two years of my MES program, to the Environmental Studies faculty, namely Sarah Flicker and Abidin Kusno, and Carlos Suárez Plascencia of the University of Guadalajara who supervised my work while in Mexico. Thank you to the community members of Melaque and San Juan who allowed me to hear and retell their stories in this research. Thank you to MITACS, the David Wurfel family and the Harold Mahabir family for your generous financial support. Thank you to my friends and family, your support has been invaluable, especially to my mother Darlene and my brother Clayton whose kindness, love and generosity was steadfast—I owe you one! And finally, to my partner Brian, who never tired of answering my queries about Filipino culture.

Submission confirmation from MES supervisor Justin Podur



Synthesis Paper

In an early fall morning of 2017, I sat in the plastic chair of my Global Cities seminar as Professor Abidin Kusno drew a diagram on the board. As the marker dragged to close a circle it bounded the words “western knowledge”. He, as he did at the start of every seminar class, began asking questions and filling in the diagram. In the end, the board depicted the schematic design of western knowledge with academic disciplines running from left to right. That morning we discussed Edward Said’s critique on cultural representation through the articles of post-orientalism authours. This seemly innocuous morning precipitated the deterioration of my deeply held belief that science, under its purview of unbiased observation and quantification was naturally positioned as a higher tenant of knowledge. Justin Podur, my advisor and supervisor, flagged my sentiment of this early on in my plan of study with the recommendation I read Thoman Kuhn’s *The Structure of Scientific Revolutions*. Sarah Flicker’s exposure to decolonizing methodologies in her *Participatory Visual Research Methods* course and post-normal science (Funtowicz & Ravetz 2003) and systematic intervention (Midgley 2003) readings from Martin Bunch’s IDS in *Systems Thinking* all provided me the theoretical understandings and vernacular to interrogate and then challenge the underlying assumptions of disaster risk management and geographic information science, two fields I have been fully dedicated to since graduating in 2007. In the last five years I have worked where disaster risk management and geographic information science overlap—disaster risk mapping. I did not set off to challenge foundations of this interdisciplinary field when I started in this graduate program and yet the work presented in this portfolio is exactly that.

The portfolio consists of 1) this synthesis paper, 2) a visual ethnography and 3) the research paper. This **synthesis paper** explains the rationale of the portfolio and objectives, in it I attempt to interweave a narrative of my experiences in the Master of Environmental Studies program that have shaped how I approached and conceptualized my research. This paper should be read first.

The second submission, the **visual ethnography** titled: *Swimming for pigs: Reframing vulnerability through reflections on culture and space in stories of disaster from a coastal community in Mexico and the Philippines*, is the conceptual design for a visual ethnography

exhibit to be held at York University Crossroads unGallery starting 14 September 2019. The visual ethnography is my way to shake off the rigidity of the traditional style of academia that leaves data siloed and intangible (Kansa, 2014; Poole, 2016) by presenting under a digital curation framework. This type of curation is the collection, transformation, presentation and preservation of data to share it and expand opportunities of knowledge creation (Betts & Anderson, 2016). Many digital curators advocate data as publication (Poole, 2016)—this is my attempt to do just that. The visual ethnography is to be viewed prior to reading the research paper and reflected on during the presentation of research findings. It serves as the open dataset available to the assessor to critique the research, but also contribute to the knowledge base of what is being explored. The visual ethnography exhibit will engage viewers to contribute to knowledge production by providing a hands-on opportunity to build and share image and textual assemblages featured in the exhibit, I will incorporate these into the research. The visual ethnography is not a static presentation of vulnerable peoples to be viewed by gallery-going eyes through damaged-centered pretenses that reinforces one-dimensional narratives (Tuck 2009). Instead, the pictures are annotated through the stories of the community members interviewed. Yes, they express suffering and loss, but also empowerment, resilience and adaptability.

The third and final submission, the **research paper**, similarly title, *Swimming for pigs: Reframing vulnerability through reflections on culture and space in stories of disaster from a coastal community in Mexico and the Philippines* presents research methodology, findings, discussion and conclusion. The title, *Swimming for pigs*, is supposed to convey incoherent imagery. The title is inspired by a community member's disaster experience of swim-walking through neck high water to rescue her pigs. Pigs are animals, and animals, whether livelihood, feral or pets, were a focus theme in many of the disaster experiences. They are often left out of our understanding of risk. A community member should not merely be thought of as a body in a single space, i.e., house, but as a dynamic element with large extensions of life and livelihood, one of them being to their animals. Pigs live on land and people swim in water. By placing the activity of swimming, with pigs, there is an imagery that something is amiss—water is not where it is supposed to be. In flood events, that is exactly what happens, water is where we assume it should not be. Finally, the title leaves many asking, "can pigs swim?", yes, they can. What I want this research to do is promote questions and create dialogue. Data is analyzed and findings result, followed by a lengthy discussion section and conclusion. However, the

discussion is not over. Disaster risk management has been a passion of mine and my professional field for seven years. With intensity of storms increasing and as climate change expands the hazard-prone geographic area, the field deserves greater attention and more dialogue. My interrogation in this subject has not concluded with the completion of this master's program, it has merely just begun.

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Swimming for pigs: reframing vulnerability through reflections on culture and space in stories of disaster from a coastal community in Mexico and the Philippines

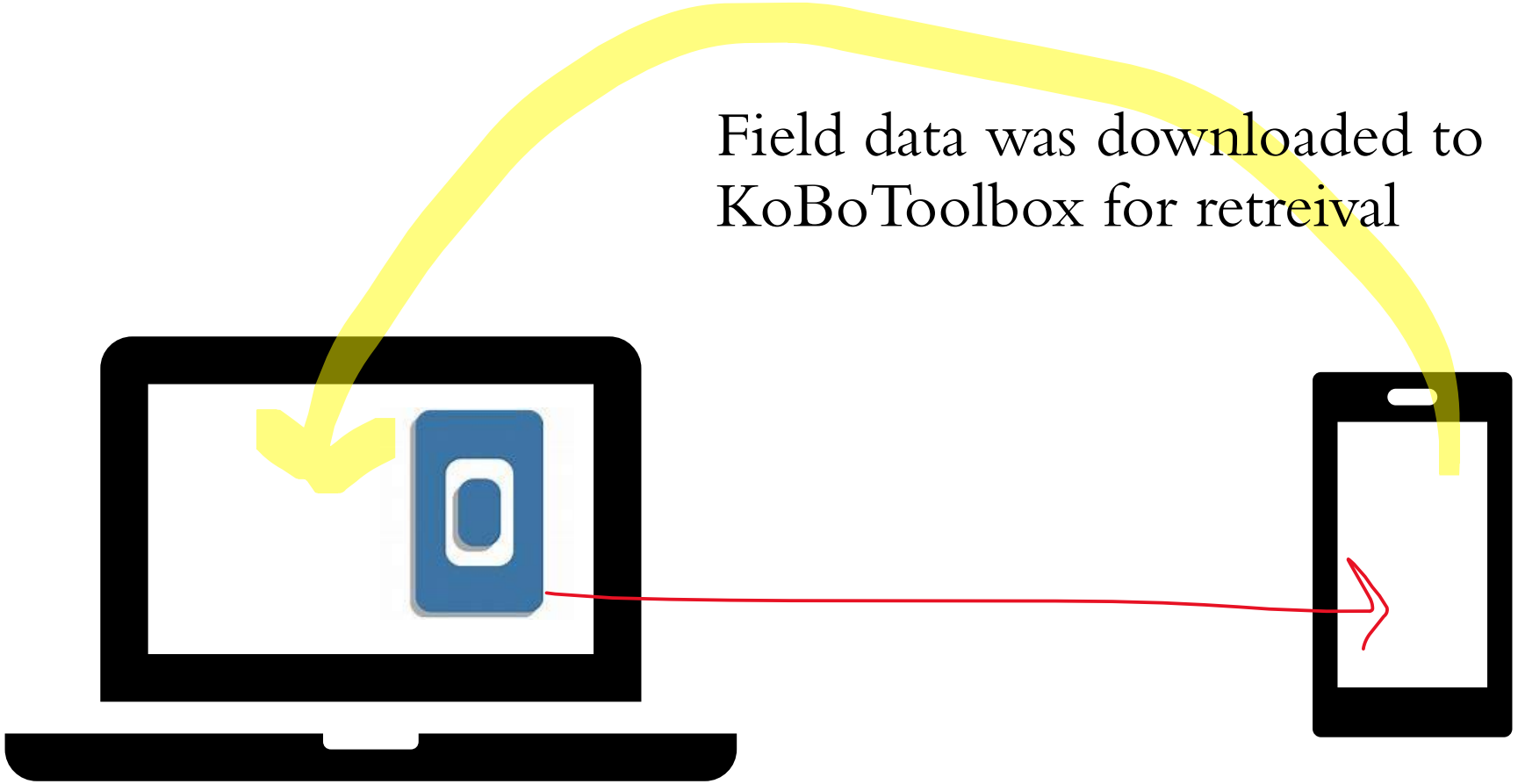
A visual ethnography as digital curation for knowledge production

Objective

Digital curation is an interdisciplinary inquiry in academia that advances knowledge by adding value to data through annotation and data sharing; spurring discussion, to produce new meanings and insight (Betts & Anderson, 2016). Under digital curation frameworks, which are many, data can be freed from researcher silos, preserved, reused and built upon. This visual ethnography attempts two things, to present data, visual and textual, to share under the curation framework for knowledge production and prepare data and annotations for a physical visual ethnography exhibit at Crossroad the unGallery.

Talking pictures

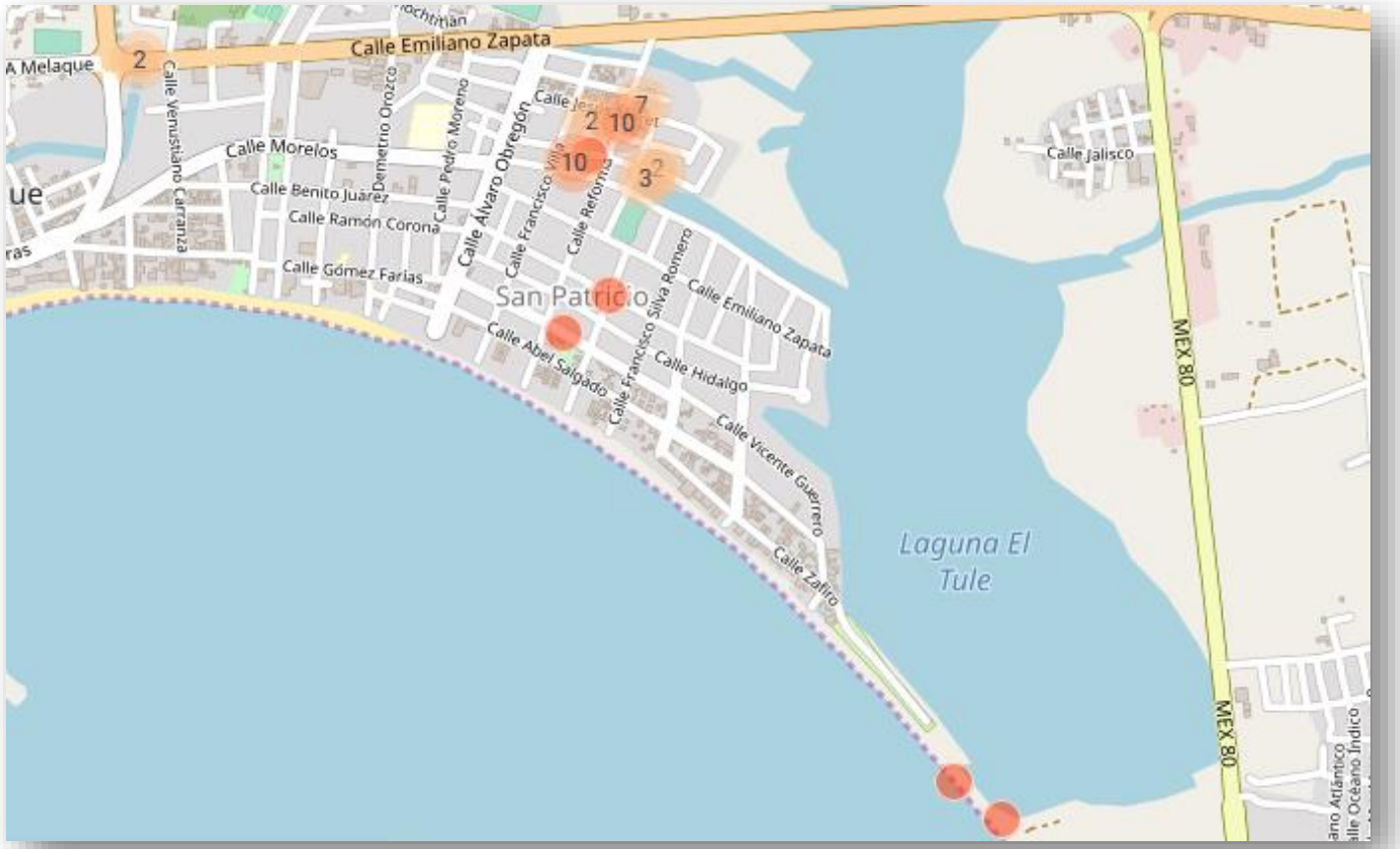
Field data was downloaded to KoBoToolbox for retreival



A simple data collection form was created in *KoBoToolbox* and uploaded to a tablet device as a mobile application

In the field, photos and videos, location coordinates and brief descriptions were recorded with the mobile application using a Samsung Galaxy Tab A 7.0 (2016) with 5 MP Camera

Melaque Flood, 2011. Mexico

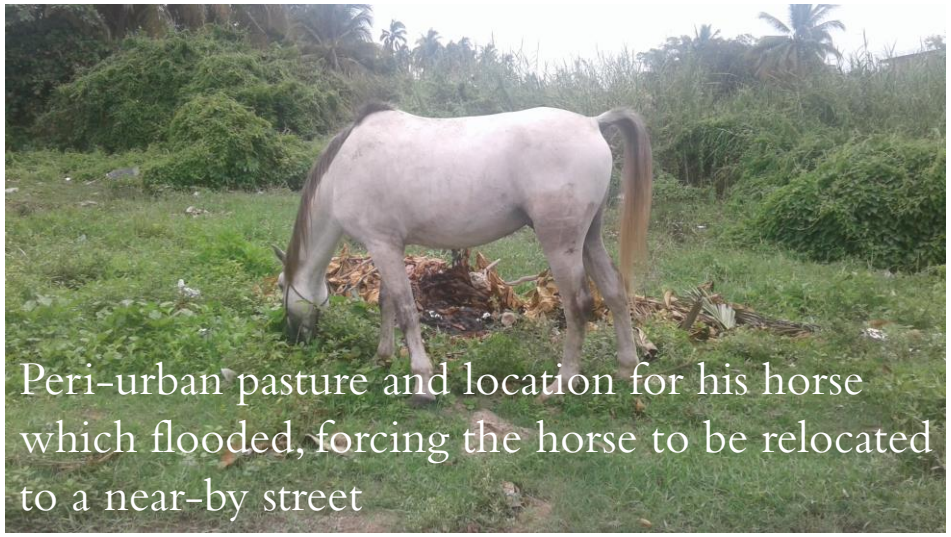


Data collection location viewed in KoBoToolbox, 2019

Hurricane Jova hit the coastal municipality of Melaque at 4am on October 12, 2011. While many community members were informed regarding the approaching hurricane few anticipated its force since the weather preceding the hurricane was calm and sunny. They awoke to "strong and quick" rushing water that soon flooded streets and homes. Officials would later understand that water overflowed the Melaque canal and coursed through the town into *Tule Lagoon* instead of directly into the Pacific Ocean. The water that entered the streets and houses was muddy and accompanied by spiders, scorpions, crocodiles (from the lagoon) and garbage. It took up to 2 days for the flood to subside and at least three days for electricity to return. The following are the stories of several community members who were affected by the flood (Curran 2019).

Narrative • Community member A

Community member A did not evacuate during the flood so he could stay with his animals (dogs, rosters, farm chickens and horse). The chickens drowned; he had to relocate the horse. He saw crocodiles eating dead animals and fruits.



Peri-urban pasture and location for his horse which flooded, forcing the horse to be relocated to a near-by street

His dogs

Community member's farm space, adjacent to his home

Lagoon-beach transition where community members worked all night to release the water from the lagoon so it could flow into the ocean

"vamos [25 vecinos, hombres y mujeres] palas…nos vamos en la noche, como las 8 en la noche, por que pase la inundación". *Melaque community member A*

We went, 25 neighbours, men and women, with shovels… around 8pm to move the water. [translated] *Melaque community member A*

The water entered here and flowed into the house. There was lots of garbage in the water. The semi-wall shown below is newly constructed—preparations for the next flood event.

Repainted walls after the flood; water was 1m high in this location

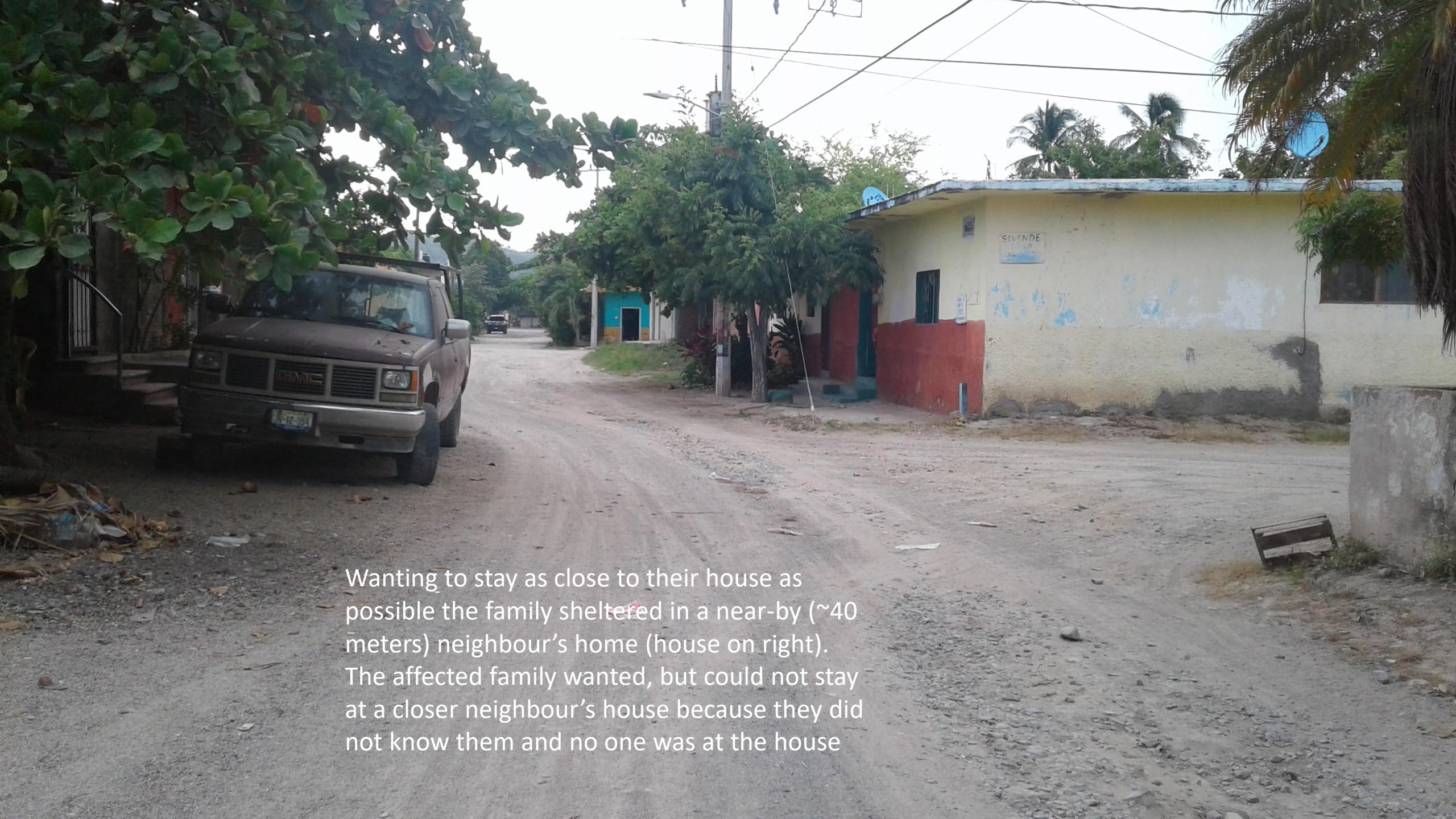
Community member R received weather alerts from the television. He and his family were in the house when the flooding started. He was concerned about the light weight material of his house.

"En términos de 2 minutos, el agua subía hasta mi cintura. Llegó a lo grande. Llegó con mucha fuerza" – *Melaque community member R*

In only 2 minutes the water went up to my waist. It came in fast and very strong [translated]

Narrative • Community member R


A rope was tied to this pole to help people cross the street and carry their things



Wanting to stay as close to their house as possible the family sheltered in a near-by (~40 meters) neighbour's home (house on right). The affected family wanted, but could not stay at a closer neighbour's house because they did not know them and no one was at the house

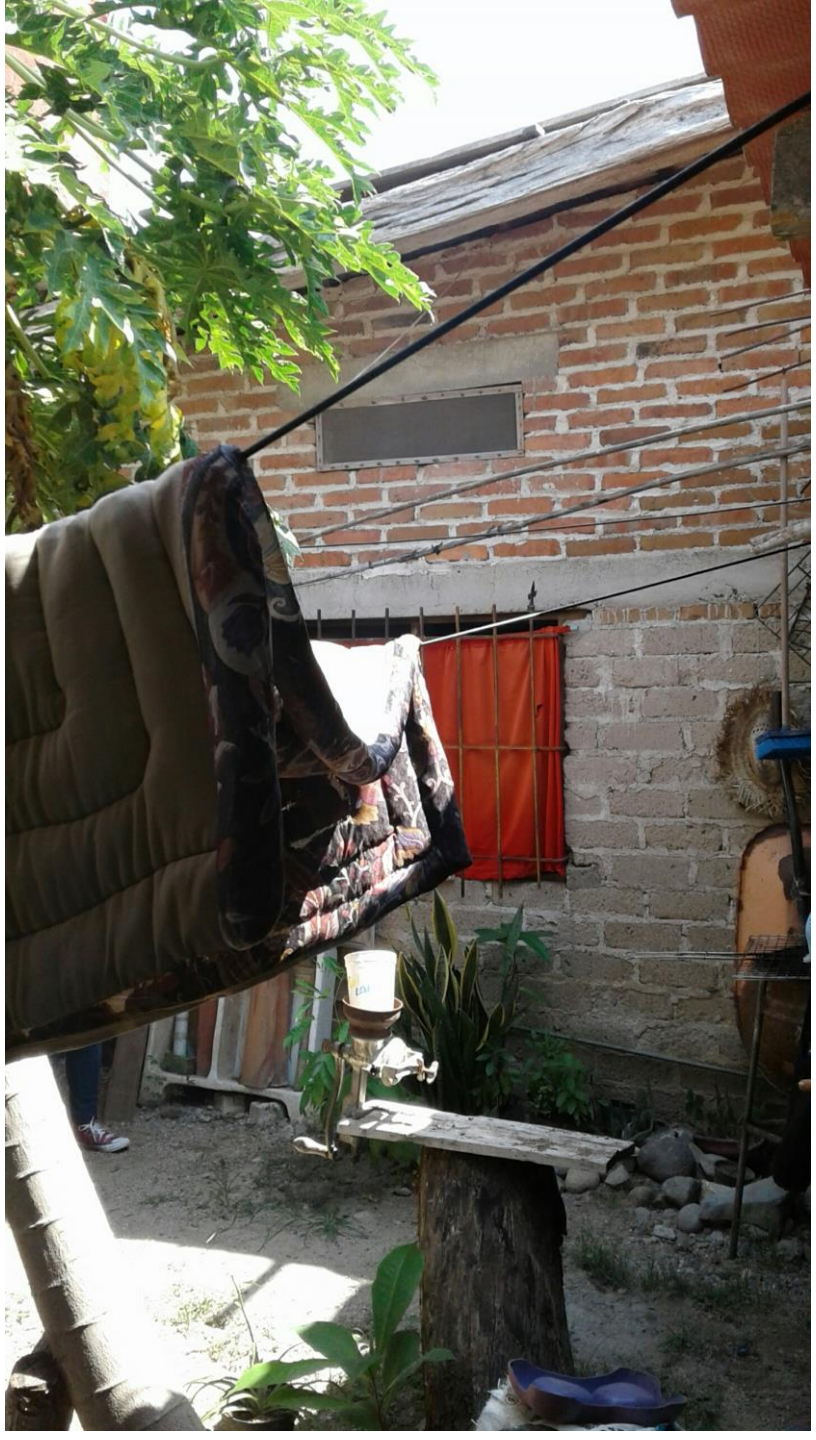
Water rose fast, lasted for 2 days, and was slow to leave

Narrative • Community member C

Community member C was alerted of the coming storm by Mexico's Protección Civil but did not think that the storm was going to be bad …"si, pero no creímos porque se veía muy soleado, como que no era cierto y por eso nos quedamos" – *Melaque community member C.*

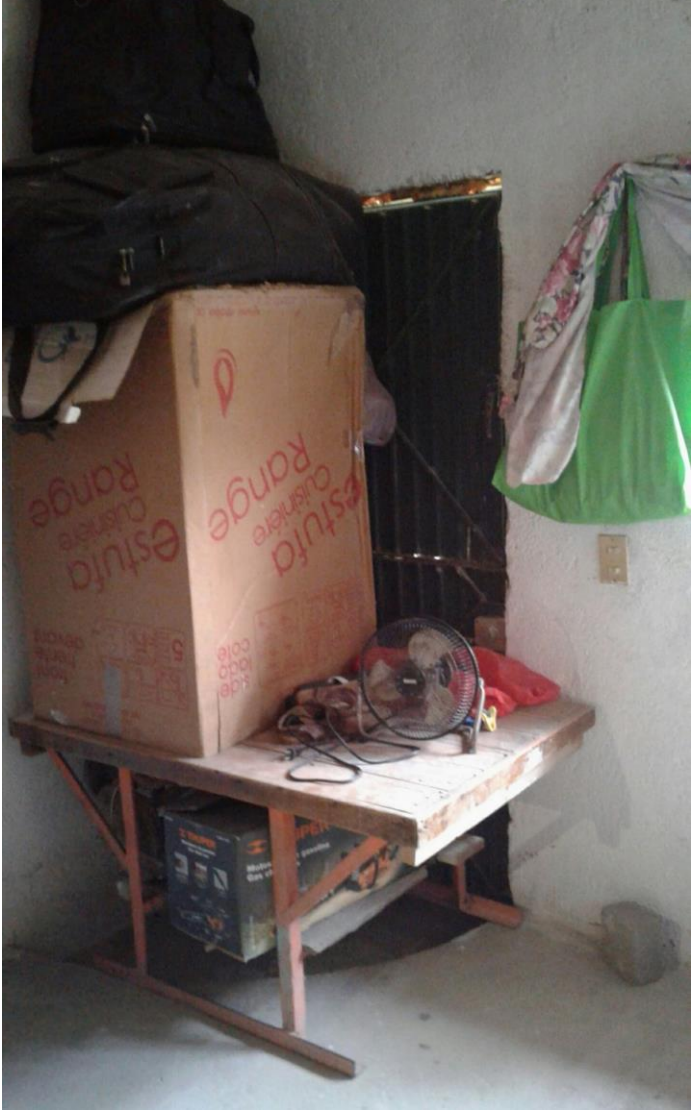
Yes, but we didn't believe because it looked very sunny, like it wasn't true and that's why we stayed [translated]

During Hurrican Jova the mango tree fell and broke part of the roof.

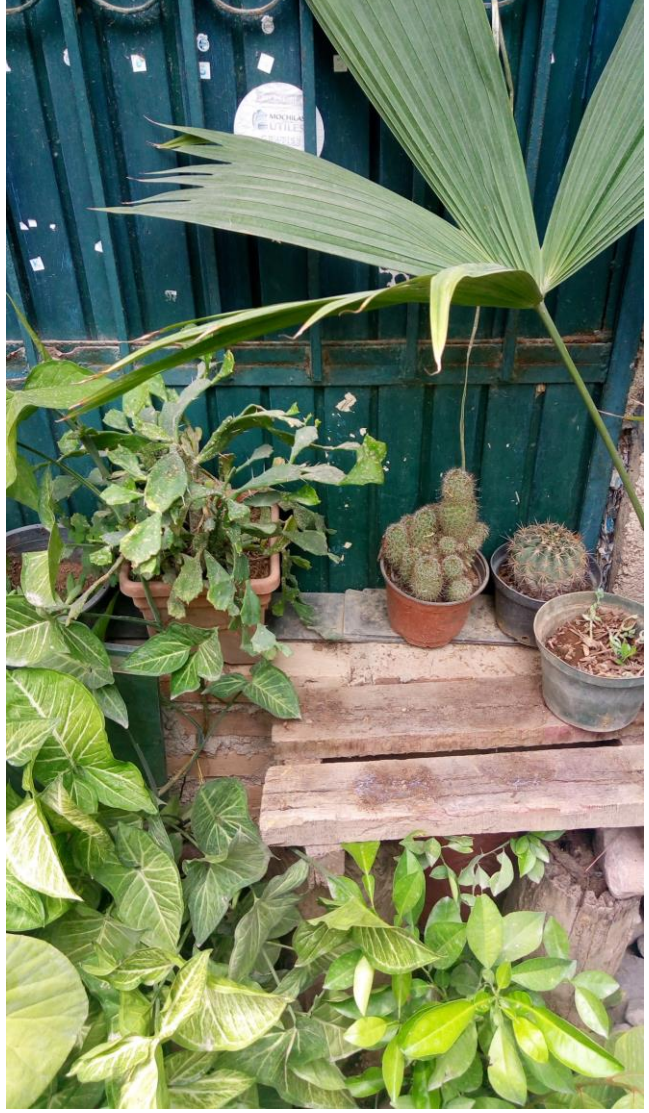


Hurricane Jova
high water marks

Holes were punctured in the wall to get the scorpion-spider-muddy water out of the house



Was a door but now unusable because it was modified to a brick semi-wall to block water (inside view)



Brick semi-wall to block water (outside view)

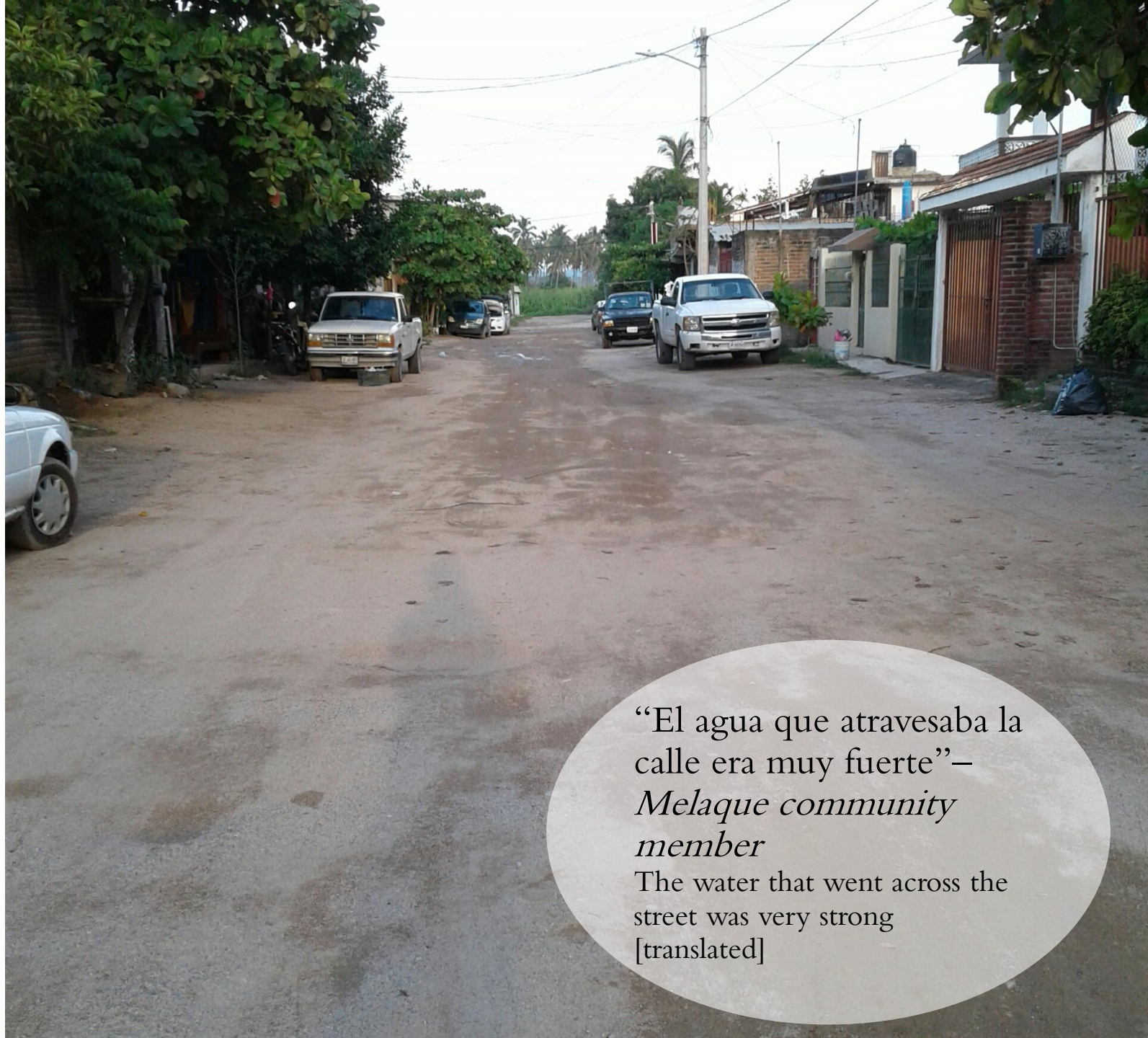
Furniture elevated on bricks—preparations for the next flood even

Community members and store owners heard the sirens alerting them of Hurricane Jova.

Narrative • Store owners and community members

This door became protected before Hurricane Jova

Hurricane Jova high water mark



"El agua que atravesaba la calle era muy fuerte"– *Melaque community member*
The water that went across the street was very strong [translated]

For three days store owners had to close for cleaning. After opening they could not sell anything that needed to be refrigerated. Electricity was off for two weeks.

Papaya sellers evacuated to a nearby school when flood waters reached 0.5 meters because their children were scared. They were alerted of Hurricane Jova from a car that drove around with a loud speaker announcing the storm. They lost all their furniture; for one week they were not able to operate their business. They saw crocodiles in the streets.

Narrative • Community members P

Community member attempted to evacuate to a school turned evacuation center through the following route that became impassable—eventually she made it to the school with her husband but it was full. They decided to go to the next town 20 minutes away to stay with family.

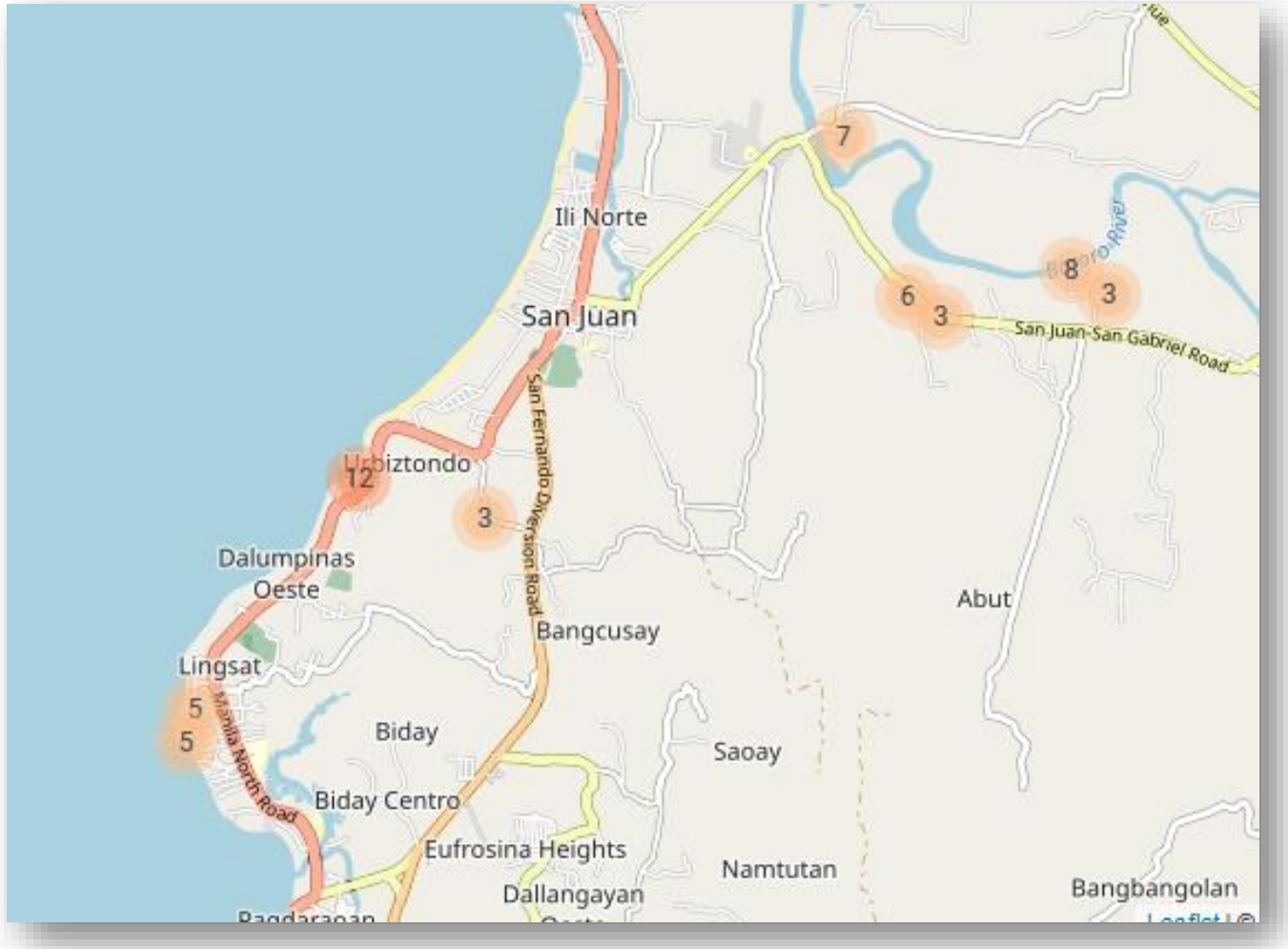
Narrative • Community member Rs.

Narrative • Community member M

Mango tree branch fell and broke part of the roof

San Juan, 2018
Philippines

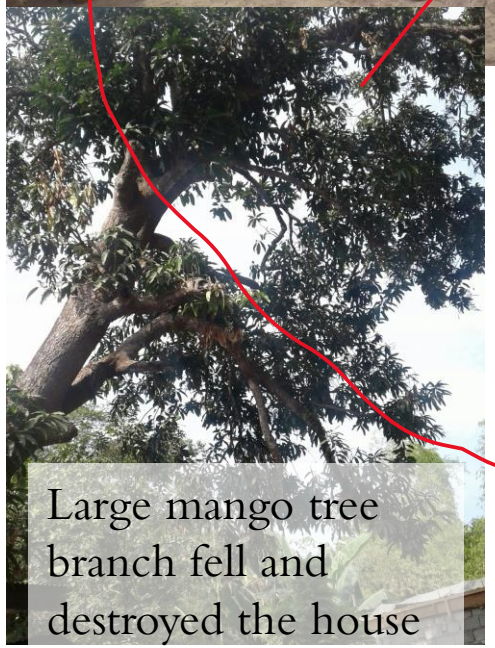
San Juan community members were informed of typhoon Ompong five days in advance and many community members stocked food and charged phones to prepare for the storm. The height of the storm occurred in the evening of 15 September with strong winds and heavy rain, though it was not as bad as recent typhoon events (i.e., Typhoon Egay, 2015). In the same evening the Baroro River overflowed its banks causing significant damage to the adjacent areas and subsided after two days. Power outages lasted from one hour to one week (Curran 2019).



Data collection location viewed in KoBoToolbox, 2019

The family compound. Community member MJ relocated her family to her mother's house while rebuilding their home

Family first evacuated to their immediate neighbour's house due to strong winds. Brick house in background is the newly constructed home



Large mango tree branch fell and destroyed the house

Narrative • Community member MJ

This is where the water came down. Very brown with lots of stones

The water flowed over the canal to knee-high level due to the many stones that clogged the drain

Narrative • Community member G

←Pigs were kept here for 4 days during the flood. Space in her compound.

Community member relocated her 7 pigs during the flood. She had to carry them out of neck-high water to the road

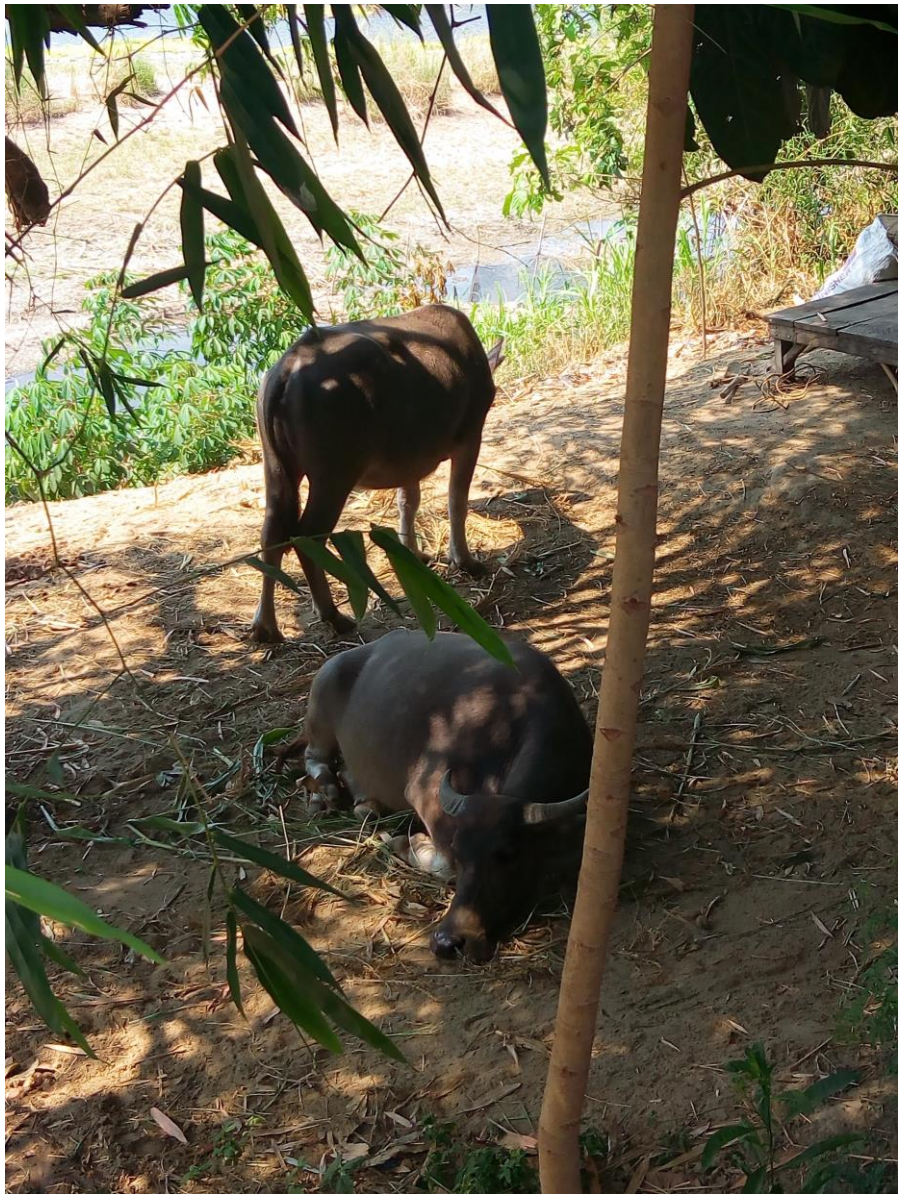
For one week there was no electricity because many trees destroyed powerlines. Community member G was able to charge her phone using the barangay hall's generator. Barangay hall flooded. (Photo courtesy of E.Lim, 2018)

Community member lives adjacent to the Baroro River. Cut banks indicate rainy season water levels (photo taken in April during the dry season)

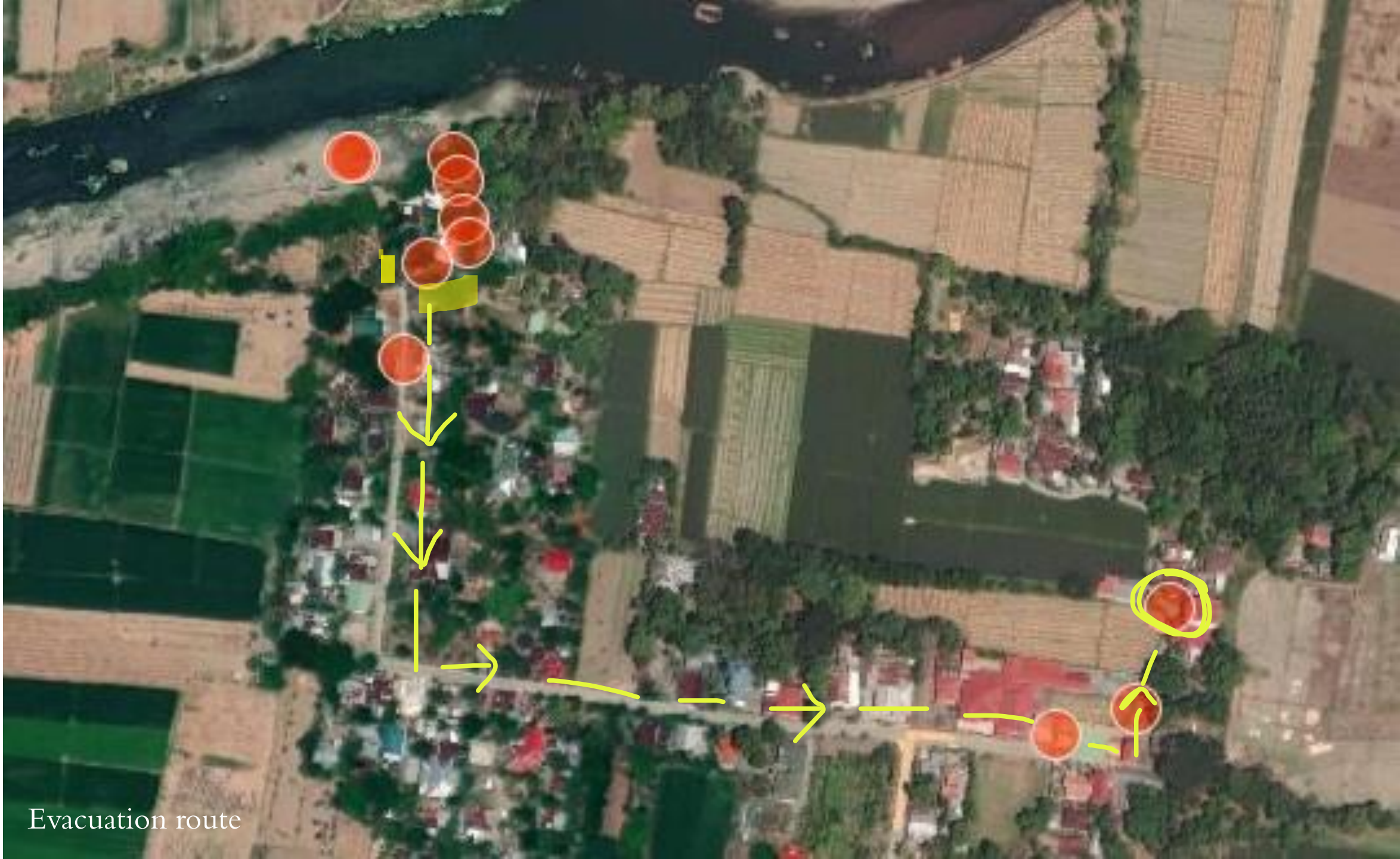
Baroro River rose to location of the house in one day during Typhoon Ompong from cut bank level

Community member and household moved their things from the ground floor to the second floor in preparation for the typhoon

When high water reached community member's knees she decided to evacuate. She evacuated with her carabaos. After she evacuated a section of her roof blew off the house.



When she evacuated the water was up to her waist (image bottom left). First she went to the church (image top right) then to her daughters house (image bottom right).


Evacuation route

She left her carabaos here in a vacant lot adjacent to the barangay hall. Other community members also stored their pigs, goats and cows here as the area did not flood during Typhoon Ompong

In the barangay hall parking lot community members stored their cars and motorcycles, the building was used as an evacuation center

Community member is also a resort owner. She received information about the typhoon from TV, radio and the community. She prepared by stocking up on water, food, charging her gadgets. During the typhoon she stayed at her ocean-side resort. Tree branches fell into the canal and onto the roof, damaging it.

Narrative • Community member P

The bamboo fence of the adjacent resort fell into the canal; community member was concerned that the canal would clog. She believes septage flow into canal through the pipes in the brick wall. After the typhoon she spent 5 days cleaning debris from the canal. At first the barangay would not pick up the debris, but after she packed debris in sacs and paid them 8,000 PhP ($240 CAD) they did

The resort had to be closed for 2 days, electricity was out for a few hours. She sheltered 15 cats during the typhoon and one assistant.

Narrative • Community member T

The storm started Sunday night, a tree feel on the roof and damaged it. For three days it rained and he had to stay in the house, but they had food because they were prepared for the storm. There was 1 and a half days without electricity

Narrative • Community member J

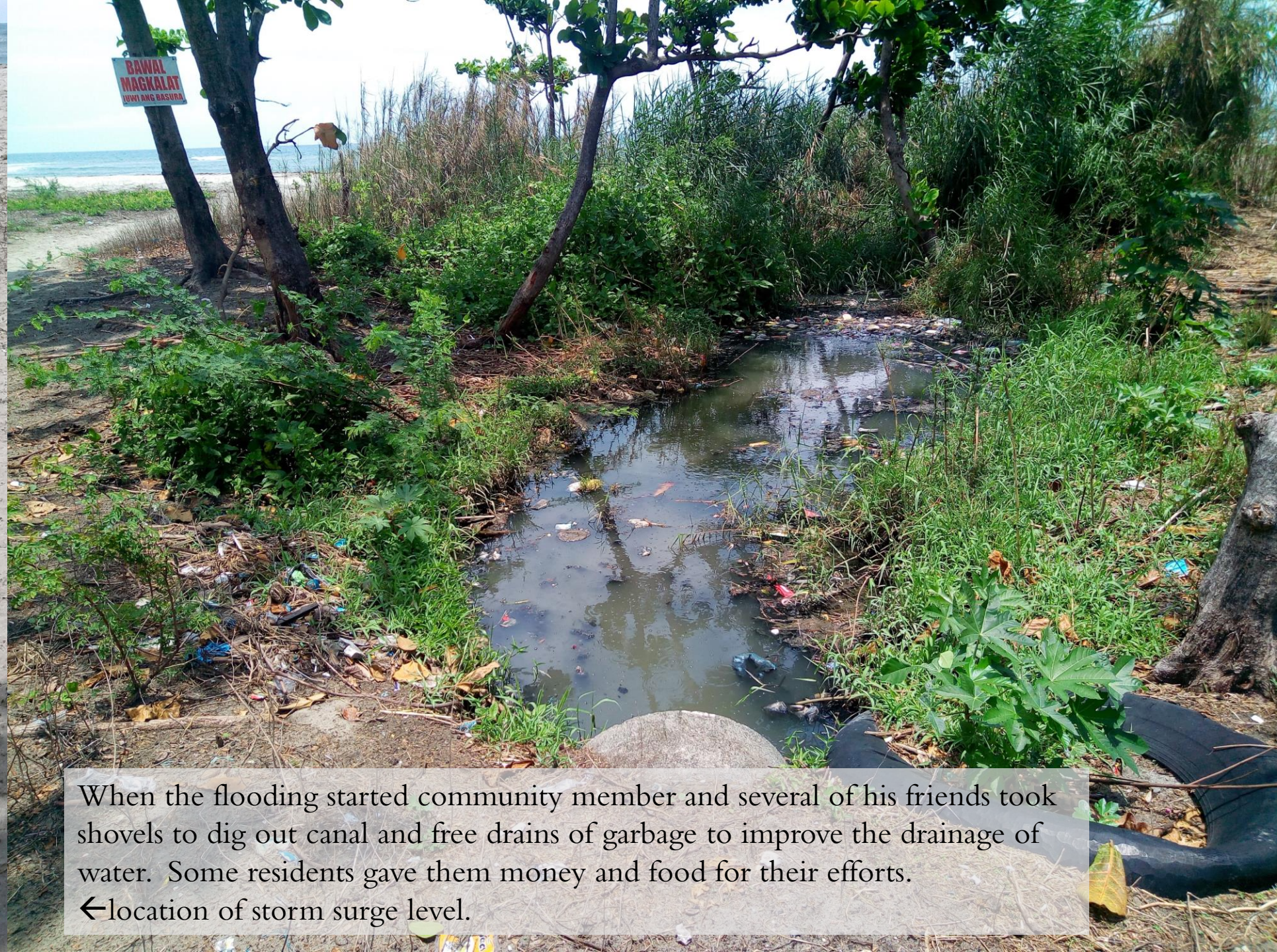
At 10am it became windy, community member went down to the ocean to check on his banca and decided to move it further inland into a vacant lot, from its normal docking along the shoreline. He noticed many branches had fallen

← Location where his and other bancas were stored.

Usual locations of his banca

It was windy all afternoon that day, the rain started in the evening. At 11pm the wind grew stronger.

High water level



When the flooding started community member and several of his friends took shovels to dig out canal and free drains of garbage to improve the drainage of water. Some residents gave them money and food for their efforts.
←location of storm surge level.

Narrative • Community member I

Community member is involved in a community association, he volunteered to monitor the beach during the typhoon. He received notice of the typhoon 5 days in advance and had time to prepare. He reinforced his ocean-side kubo by placing plastic over the exposed sides of the building and foam in between bamboo wall gaps

Bamboo poles were used to prevent his roof from blowing off, a buoy was filled with water and tired to a branch to keep it from thrashing against the roof.

In the background, thatched kubo roof is tied down

★Picture courtesy of community member

Prior to the typhoon the kubos that traditionally dot the Urbiztondo beach offering surf lessons to tourist were dismantled. Thatched roofs were taken off the bamboo poles and placed further in on the beach along with surf boards

Traditional kubo (above)

Location of dismantled thatched roof during typhoon Ompong ⋆ photo courtesy of community member (top right)

Traditional roof-pole locking mechanism that allows roofs to be dismantled (bottom right)

Many oceanside residents evacuated to nearby houses of friends and family. Storm surge was not as bad as was expected. Community member patrolled through the night and constantly communicated with association members through FB messenger. Power and electricity never went out. He received relief goods (1 kg of rice, 3 canned goods, 4 packs of noodles and 3 eggs) from the provincial disaster risk reduction management council

←storm surge level. *photos courtesy of community member

The upper section of the wall collapsed during storm and part of the roof of the community member's 100 year old heritage home. Before the storm the upper wall was vertical wood strip panels, now these panels are discarded at the side of the house

Narrative • Community member R

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Research paper

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Swimming for pigs: Reframing vulnerability through reflections on culture and space in stories of disaster from a coastal community in Mexico and the Philippines

Keywords: vulnerability, resiliency, socio-spatial, radical geography

Introduction

The epistemological framework for assessing and mapping disaster risk is a construct of western knowledge—a reductive process of equating risk to the product of hazard, exposure and vulnerability. Hazard and exposure, quantified through methods of geospatial modelling, have generally been accepted. Calculating vulnerability, on the other hand, is more complicated. The United Nations Office for Disaster Risk Reduction defines vulnerability as: the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards (2009). If complex social processes, like culture, place-making and relationship hierarchies, encompass vulnerability, then disaster is cultural.

Critical social theory, and radical and feminist geography scholars have already framed disaster in cultural terms (Bankoff 2012; 2015; Donovan 2017; Gaillard, Fordham & Sanz, 2015; Oliver-Smith 2015) however risk management practitioners continue to apply a reductionist approach. Beccari (2016) found that of 106 risk calculation methodologies, none of them transferred from a regional to local scale of analysis and concluded that "oversimplifying complex concepts such as vulnerability and resilience…may be reducing their [assessment] utility for policy makers or even leading to poor decision making" (para. 14). What's worse is that risk assessments and risk maps have in the past been misused (continue to be misused) as instruments to remove informal and "at risk" dwellers from their homes (Bayani, Dorado, & Dorado, 2009; Claudianos, 2014). This process is akin to weaponizing science to dismantle civil liberties (Donovan 2017).

Vulnerability can, if studied critically, better reflect the realities of disaster risk and strengthen the functionality of risk maps and risk assessments. Fekete (2019) recommends improved understanding to find viable vulnerability assessment criteria to map risk effectively and transform place-based or mapping approaches (Fekete, 2019 references Sherbinin, 2014). I seek to identify the socio-spatial understanding of disaster to uncover elements of vulnerability. Looking at disaster experiences through a socio-spatial lens provides the opportunity to

challenge the reductionist practices of quantifying space to measure risk and draw from the expansive work of Harvey, Lefebvre, and Massey to intersect theories of place, culture and disaster.

Tuck and McKenzie (2015) suggest the spatial turn form of inquiry use narrative, arts-based, and spatial ethnography as methodology, inclusive of visual and mobile methods. In keeping with this suggestion, in two separate, culturally diverse spatial locations, I gathered disaster experiences using the narrative inquiry approach. The approach, grounded in principles of decolonizing methodology (Smith 2012) empowered community members to guide the focus of the research, removed rigidity from the research framework and reduced researcher subjectivity during interviews.

Methods

The research takes on an experimental approach of narrative inquiry to understand socio-spatial aspects of disaster by recording disaster experiences that were spurred by a single hydro-meteorological event in two distinct locations. San Juan, La Union, Philippines was selected as it experiences frequent tropical cyclones, but mostly because it is the location I have lived and worked for long periods of time since 2012. It is a place where I know the community, local language and culture and where I have experienced several tropical cyclones. The second location, Melaque, Mexico, is similar in size, population and geography to San Juan and experienced a devastating cyclone in 2011.

Study Sites

The municipality of San Juan is located 250 km north of Manila on the western coast of Luzon Island. The 5,712 hectare peri-urban area is dominated by agriculture in low-lying areas and a gentle coastline with terrain that rises 190 m asl. The municipality consists of forty-one barangays[1], of which, eighteen transect the Baroro River. Many of the 45,516 residents work in the City of San Fernando to the south, in agriculture and/or in the tourist area of Urbiztondo, the southwestern most barangay. The municipality is known as the "Surfing Capital of the North", increasingly attracting Filipino and international visitors.

In the late morning of 15 September 2018 tropical cyclone (Typhoon) Ompong, known internationally as Mangkhut, struck San Juan. According to the National Meteorological and

[1] Barangay is the smallest administrative unit in the Philippines. A barangay is similar to a neighbourhood.

Hydrological office, PAGASA, it carried sustained winds of 145 km/h and gusts of 165 km/h. The region experienced a 4-day rainfall of 750 mm, with 500 mm falling on 15 September. Damage was assessed at PhP16.7 billion (C$410 million); eight people died, two went missing and twenty-one were injured (PAGASA, 2018).

San Juan community members were informed of Typhoon Ompong five days in advance and many community members stocked food and charged phones to prepare for the storm. The height of the storm occurred in the evening of 15 September with strong winds and heavy rain, though it was not as bad as recent typhoon events (i.e., Typhoon Egay, 2015). In the same evening the Baroro River overflowed its banks causing significant damage to the adjacent areas. Water subsided after two days and power outages lasted from one hour to one week (Field notes 2018 & 2019).

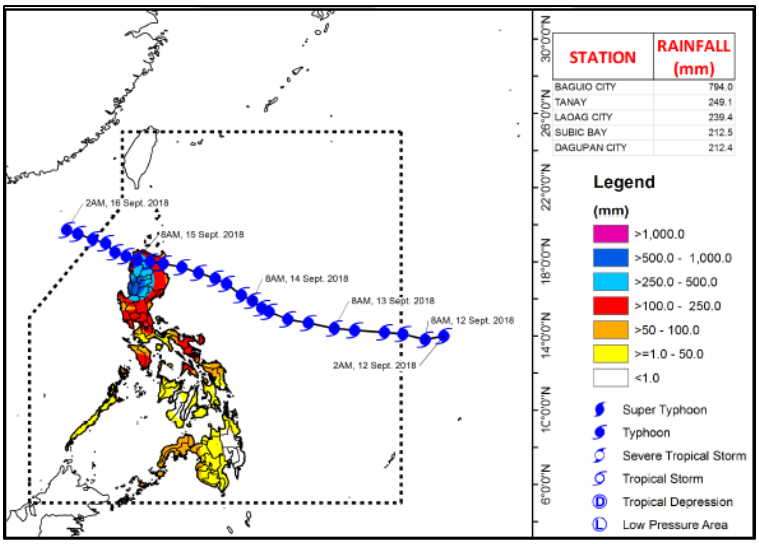

Figure 1. Precipitation and track of Typhoon Ompong. Study site is located in the highest precipitation area. Source: PAGASA, 2018

Melaque is a coastal town in the municipality of Cihuatlan, Jalisco, Mexico. It is positioned along the central Pacific coast and is prone to earthquakes, tsunamis and tropical cyclones. The town has a thriving central area with a plaza, banks, and restaurants that cater to national and international tourists. With a population of 7,569 it is less populous than San Juan, but it is similar to the Urbiztondo Barangay in San Juan, where much of the research was proposed.

Tropical cyclone (Hurricane) Jova made landfall on Mexico's Pacific coast at 1am on 12 October 2011 with sustained winds of 160 km/h and gusts of 195 km/h and 350 mm of rainfall in a 5-day

period (Government of Mexico, 2011). No economic loss or damage data was released by the government, a technical report for Colima State (2014) listed an economic loss of MXN204 million (C$1.6 million) and nine deaths but did not indicate the spatial scope nor data source.

Hurricane Jova hit the coastal municipality of Melaque at 4 am on 12 October. While many community members were informed about the approaching hurricane few anticipated its force since the weather preceding the hurricane was calm and sunny. They awoke to "strong and quick" rushing water that soon flooded streets and homes. Officials would later understand that water overflowed the Melaque canal and coursed through the town into Tule Lagoon instead of directly into the Pacific Ocean. The water that entered the streets and houses was muddy and accompanied by spiders, scorpions, crocodiles (from the lagoon) and garbage. It took up to 2 days for the flood to subside and at least three days for electricity to return (Field notes 2018).

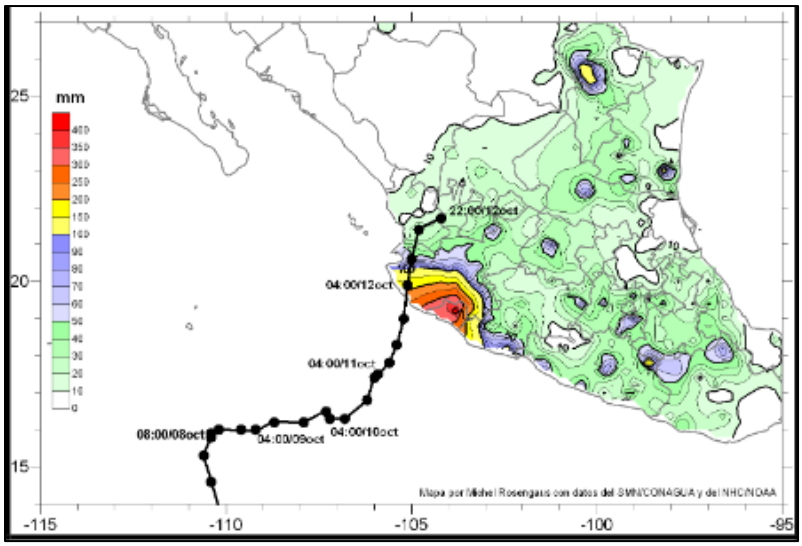

Figure 2. Precipitation and track of Hurricane Jova. Study site is located in the highest precipitation area. source: Government of Mexico, 2011

Taking pictures

Community members were selected through snowball sampling in locations that were impacted by Hurricane Jova in Mexico and Typhoon Ompong in the Philippines. Through semi-formal interviews, members shared their experience of the hydro-meteorological event—mostly through walking interviews. Few guiding questions were posed during interviews to reduce researcher interference in the retelling of disaster experiences. When necessary clarifying

questions were asked. Typically, the beginning of the interview took the following form of inquiry:

*Researche*r: "so, where were you during Typhoon Ompong?"
Community member: "in the house"
Researcher: "what time was it when the typhoon started?"
Community member: "the wind started earlier than the rain, it was 11 am. I was nervous about my animals, so I went out to check on them"
Researcher: "oh, what kind of animals do you have?"
Community member: "well I have pigs now, but before they were goats. I had to move them during the typhoon because it flooded up to my waist. I brought them to my friend's house because his didn't flood and there was no space at my house."
Researcher: "can I take a picture of where your animals were?"

Once photo-taking was prompted the walking interviews began and community members, generally, became more at ease and spoke at length about their experience. A Samsung Tab A tablet was used with a mobile application called KoBoCollect to take georeferenced pictures and videos of objects and locations referenced by community members. In most cases the community member was shown each picture for approval. Initially a participatory mapping/photo-voice research method was proposed, but community members did not want to take videos or pictures and it was clear that the research method needed to adapt.

Viewing pictures

Level 1 – Micro Assemblages

Annotated pictures and videos, interview documentation and field notes were reviewed and synthesized for each community member—once the collection of media was assembled it was referred to as an assemblage.

Figure 3. Visual display of a micro-assemblage

The use of assemblages and assemblage theory, popularized by Deleuze and Guattari in the 1980s, recognizes the community member experience as a set of complex and heterogenous physical and immaterial artefacts that display multiplicities of emotion, action, perception and materiality over time and space. Assemblages do not form a totality and are not reducible to their parts, rather the focus is on the interactions of the parts, each part not mutually inclusive and attached to other assemblages (DeLanda 2006; Doel & Clark, 2004). According to Donovan (2017), assemblage theory is ideal to explore the transdisciplinary space of disaster risk.

Because the collection of media are at the individual scale and several nested assemblages are analyzed in the research, these individual collections of data are referred to as micro-assemblages. Querying the assemblages using the following guiding questions allow focus themes to emerge: 1) What did the community member focus on in her retelling of the disaster experience? and, 2) what was the spatial distribution of his experience? Focus themes and spatial distribution for each experience were recorded.

Level 2 – Meso Assemblages

Each micro-assemblage was merged together into a meso-assemblage bounded by the geography of the study sites. There are two studies sites in the research, therefore two-meso assemblages were analyzed. For each meso-assemblage focus theme commonalities were identified, recorded and ranked by frequency. Focus theme commonalities are any focus theme that share a commonality with another experience in the meso-assemblage, for example, if a community member spoke of an animal or animals in her story and animals were mentioned in another experience then *animal* would be a focus theme commonality with a frequency of two; if no other experience in the meso-assemblage referenced an animal then it would not be a commonality. Images and experiences were analyzed under what Sarah Pink terms the

'reflective approach', where the viewer considers subjectivity, incomplete image representation, cultural context and possible pluralisms in meaning and representation (Pink, 2001, p. 99).

Level 3 – Macro Assemblage

Meso-assemblages from each study site were compared in a macro-assemblage. This wide-angle look allowed for commonalities of focus themes to be uncovered across the socio-spatial gradient. Just as in the meso assemblage, common focus themes were recorded but remain bounded by their study site.

Results

Melaque, Mexico

Seven community narratives and corresponding media were collected during field work in Melaque, Mexico from June-August 2018. Community member interviews lasted between 30 minutes to two hours. Interviews were given in Spanish and data collection was undertaken with the help of a field assistant/translator. Eight focus theme commonalities were identified and ranked by frequency, as shown in table 1 below: material loss, evacuation, roof, structural modification, crocodiles/scorpions, assistance of people, trees and business disruption, with, 100, 57, 43, 43, 43, 29, 29 and 29 percent frequency respectively.

Table 1 Common themes emerging in interviews, Melaque

Theme	Number of times it arose	Percentage of times it arose
Material loss	7	100
Evacuation	4	57
Roof	3	43
Structural modification	3	43
Crocodiles/scorpions	3	43
Assistance of people	2	29
Trees	2	29
Business disruption	2	29

In all interviews, material loss was mentioned, referring to the loss of furniture and household appliances. In two experiences, material loss additionally referred to the loss of chickens, and products (papayas and cold goods). Evacuation was referenced in four stories: three of the four community members evacuated during the flood and in one experience they evacuated prior to the flooding. In only one experience did the community member go to an evacuation center, the rest stayed with family or friends near-by.



Image 1: Semi-walls as structural modification following flood events. Image1a (left above); image 1b (right above); image 1c, (bottom right)

Structural modification and roof were focus themes in three community experiences, however there seems to be no correlation between the two themes—structural modifications did not relate to repairing or modifying roofs. Three community members mentioned modifications to their property. Community member C punctured a hole in her brick wall to remove the water from the home, after the flood they patched the hole. Additionally, her and her husband converted a side door to a window by building a semi-brick wall against the outside of the door to prevent water from entering in future hydro-meteorological events (Image 1a). They began construction on a second floor and using bricks, raised their couch and refrigerator. Member A built a semi-wall in his yard adjacent to the lagoon where flood water entered his property (Image 1b). Community members and store owners talked about a protected door that had been modified following the flood event prior to Hurricane Jova (Image 1c).

Roofs were mentioned in two different contexts. In two experiences tree branches fell and damaged roofs while in community member R's experience he was nervous that his lightweigh corrugated iron (CI) roof would blow off. This is not an isolated fear, several commuity members who did not want to take part in the research did reveal that they evacuated or slept in different rooms because they were nervous about their CI roofing.

The crocodile/scorpions theme was mentioned three times, the same frequency as roof and structural modifications. Crocodiles came in with the flood waters from the adjacent lagoon and were seen swimming through streets eating dead animals and fruits. Scorpions and other insects were carried with the water. No one reported any incidents of attack or harm by the crocodiles. The focus themes tree(s) and business disruption were mentioned in two experiences. In both experiences tree branches were responsible for damaging roofs and two commuity members experienced business disruption.

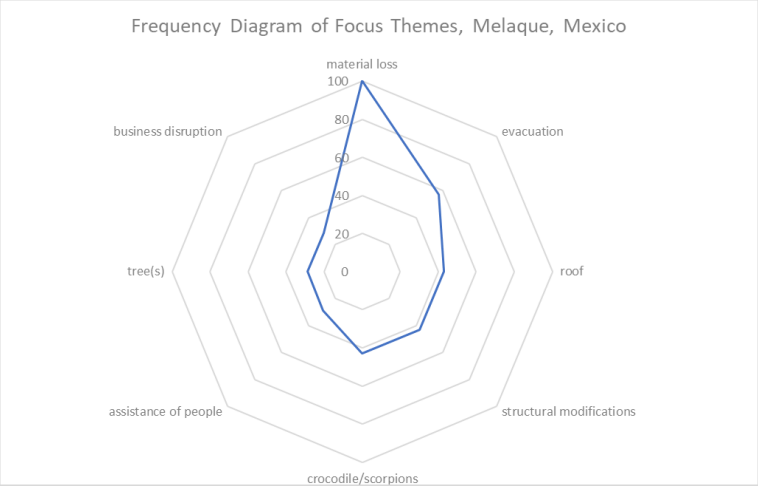

Figure 4. Frequency diagram of focus themes. Melaque, Mexico

San Juan, Philippines

Eight community narratives and corresponding media were collected during eight months of field work from October 2018-May 2019. Community member interviews lasted between 30 minutes to 2 hours. Interviews were given in a mix of English and Ilokano[2]. Eight commonalities were identified and ranked by frequency: roof, trees, assistance of people, animals/livelihood barangay hall, structural modifications, evacuation and digging with, 88, 75, 50, 50, 50, 38, 25 and 25 frequency percentage respectively.

Table 2. Common themes emerging in interviews, San Juan

Theme	Number of times it arose	Percentage of times it arose
Roof	7	88
Trees	6	75
Assistance of people	4	50
Animals/livelihood	4	50
Barangay Hall	4	50
Structural modification	3	38
Evacuation	2	25
Digging	2	25

In nearly all experiences roof was mentioned except one, the most common reference begin to a damaged roof, while one community member referred to preventative actions taken to protect roofs in his immediate community. Closely associated to roofs are trees. In the six experiences

[2] Regional language of northern Philippines

where roofs were damaged, three were caused by tree branches, other references were regarding: i) surprise that no trees caused damage, ii) fallen trees branches responsible for bringing down powerlines, iii) tree branches clogging a canal and iv) tree branch restraint to prevent it from thrashing during the typhoon. Assistance of people, animals/livelihood and barangay hall were all mentioned in 50% of experiences. Two community members mentioned assistance of people through actions of digging debris to improve water flow, in one experience it was related to working together in disaster preparedness and response and the last reference related to evacuation. Animals/livelihood were grouped together as a focus theme since two of the three referred to animals in the context of livelihood and one community member discussed his banca (boat) in a similar context. There was a reference to domestic cats—fifteen of them were sheltered by a resort owner during the typhoon. Barangay hall was related to assistance in the form of providing the following services: 1) a place to store evacuated animals, 2) a place to charge cell phones, 3) point of contact for community preparedness mobilization and 4) a service for debris removal. Structural modification appeared in three community member experiences—the first was as a description of changes made to beach kubos (thatch huts), the second, for the rebuilding of a more resistant house that was destroyed during Typhoon Ompong and thirdly, the change of building material for the repairs of a house partially damaged during the typhoon. Two experiences mentioned evacuation, one a week-long while the other community member and her family are still not in their home as it is being rebuilt. Digging was also referenced in two experiences—both as the action of clearing debris to release water.

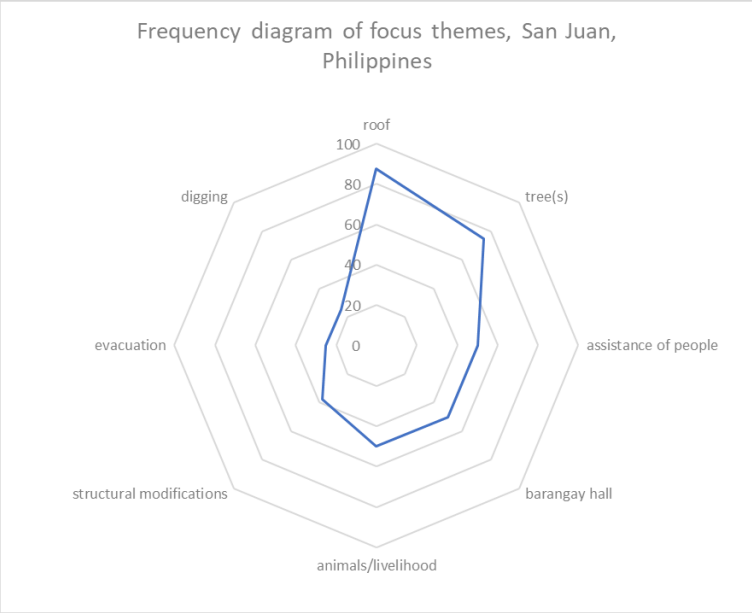

Figure 5. Frequency diagram of focus themes. San Juan, Philippines

Mexico-Philippine focus theme comparison

Nine focus themes were linked in the macro-assemblage analysis. The highest match of frequency was between structural modifications and animals. The most dramatic difference was with material loss, mentioned only once in a Philippine experience and in all Mexican experiences. Digging was featured in only one experience in the Melaque study site and therefore was not included as a focus theme commonality at the meso-assemblage scale but became a commonality in the macro-assemblage analysis. Trees, roof, evacuation, assistance of people and digging were the most contextually similar while animals and structural modifications were contextually disparate. Barangay hall was removed as a focus theme commonality because there was no contextual equivalent in the Melaque assemblage. Crocodile/scorpions and animals/livelihood had to be modified to animals for the analysis and the San Juan experience regarding a banca, as livelihood omitted, therefore under the macro assemblage *animals* mean any animal mentioned in the experiences, as such the animal theme is also contextually different between the two meso-assemblages.

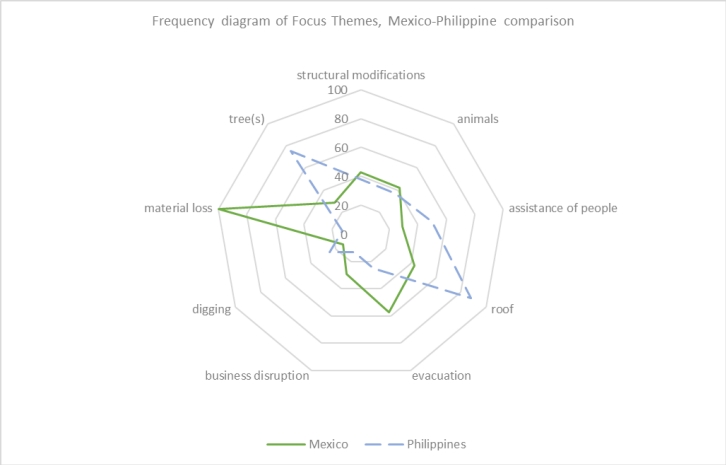

Figure 6. Frequency diagram of focus themes, Mexico-Philippine comparison

Discussion

The experiences give first hand accounts of what happens during a flood. It rains, and water accumulates in space, unequally, due to topography and planning. It flows into rivers, filling and overflowing them and vanishing land into watercourses. The wind pushes waves that surge into coastlines, backing up canals, rivers, creeks and lagoons preventing water from draining into oceans. The accumulation of water in spaces breaks things, like canals, and brings things, like scorpions, crocodiles and debris. Strong winds break trees and branches fall, sometimes on roofs, powerlines and roads. Space undergoes a transformation; in turn people react.

People move to secure their property, livestock and boats and people also stay to protect their property. They move to water with shovels to free it and break things to relieve it from their home. When water and wind abate people react still to rebuild and modify what has been broken and move things and people that have been temporarily displaced. The entire phenomenon is one contraction and release of a physical space, but these spaces do not rebound to their original form—they become irrevocably changed, physically modified and emotionally imprinted.

From a wide-angle view the experiences demonstrate a complex set of actions and emotions occurring on a space. Far removed from the static interpretation of a risk map we see people dynamically acting upon space. The map's attempt to capture disaster risk is limited not only by static temporality and incomplete data but by its folly to think that it could do so in the first place. Space is a multi-layered surface (Massey 2005; Lefebvre 1991) where life happens (Tuck and McKenzie, 2015, p. 8), it "…resists analysis because of its novelty and because of real and

formal complexity" (1991, p.289). This complexity provides strong argument to problematize the reductive approach of current risk mapping, which, in essence, is the mapping of space.

Vulnerability

Vulnerability is the third component in the risk assessment process and is defined as the physical, social and environmental factors and processes that increase susceptibility to a hazard. Hazard and exposure, the first and second components, can be clearly defined. Hazard is the physical event (i.e. rockslide, flood, earthquake, and cyclone); exposure is the extent of people and assets in hazard-prone areas (UNISDR, 2009). Seemingly, vulnerability is easily defined, but in practice it is extremely complicated to capture. Many practitioners divide vulnerability into two categories, physical vulnerability, which pertains to conditions and materiality of physical assets (i.e., building material) and social vulnerability, which focuses on individual and societal characteristics, like income and education level. Research by Fekete (2019) suggests that even today there is uncertainty regarding the definition and scope of vulnerability terms. Even when terms align, Fekete rightly asks, what should be acceptable vulnerability thresholds; does scale affect vulnerability indicators, and what are the vulnerability considerations for rural versus urban settings? In agreement with Fekete's interrogation on vulnerability the discussion below places the vulnerability findings in the rural/peri-urban context at a local scale.

To make such assertions I adopt a socio-spatial framework grounded in the belief that the social can be assessed through place-based inquiry (Lefebvre 1991; Low, 2014; Massey 2005; Midgley 2003; Tuck and McKenzie 2015) and that cultural relevance is intrinsic to the interdisciplinary study of disaster risk (Bankoff 2012; Donovan 2017; Gaillard, Fordham & Sanz, 2015; Oliver-Smith 2015). Assemblage theory was applied to ethnographic data to produce themes relevant to disaster vulnerability, however socio-spatial framing was needed for the difficult task of making cultural meaning of pictures, text and field observations. The mixed-method approach provides the pluralism needed to untangle vulnerability from its intersectionalities within culture and space (place) and more importantly to highlight resiliencies that manifest through cultural practices. Regardless of the method, deducing culturally framed societal characteristics from these media is rife with problems (Pink 2001). In this challenging terrain I reflect upon Low's (2014) considerations when 'spatializing culture': 1) social production (ie. social, economic, ideological processes that create the physical space), 2) social construction (ie. People's interactions, imaginaries and use or absence that give space meaning), 3) embodiment

[embodied space] (a person as a mobile spatio-temporal unit with social characteristics) and 4) discursive practices (pg. 35).

Cultural contextualization of themes

Roof, trees and assistance of people

Themes *roof* and *trees* do not appear to have cultural distinction and are important vulnerability indicators. Trees fall during cyclones and cause damage, partial or complete, to buildings and roofs. Therefore, the condition and material of roofs as a physical vulnerability indicator is warranted and important cross-culturally. Given that damage from trees was prominent in the Mexico and Philippines disaster experience it is interesting that tree cover is not a generally accepted input in risk assessments nor is tree maintenance a vulnerability indicator in a standard assessment.

Generally, social vulnerability is mapped using socio-economic and demographic data. Age, income and education level are the standard data used in assessing the societal impact from hazards (Fekete 2019). In Mexico, factors such as access to piped water, access to electricity, indigenous population and population with disabilities are sometime used (Puerto Vallarta Risk Map, 2012; discussion with Carlos Suárez Plascencia 2018). No socio-economic data was taken during field collection but based on field observations neither education, income nor age seemed to play a significant factor in a community member's vulnerability. Community member A who dug to release water from the lagoon is a ~60-year-old farmer; in the Philippines, Community member J who dug to release the standing water and Community member P who removed debris from a canal are a 28 years old fisherman and a middle age resort owner. What is important in these stories is not age but physical ability and the assistance of people.

Of those who evacuated one was an elderly woman who once served in local politics and another a middle age grounds keeper, others were young and middle-aged families. A commonality in the stories was that community members preferred to shelter in place, or as close to their homes as possible. To do this, they relied on the assistance of people, mostly family members and those living close by. The theme *assistance of people* did not have a cultural distinction in the Mexican or the Philippine experiences. A vulnerability indicator that considers likelihood for people to lend assistance would be hard to quantify but is observed to be important for reducing vulnerability in both the Philippine and Mexican context.

Space and structural modification

Use and modification of space features prominently in decreasing vulnerability in culturally distinct ways. In the Philippines various spaces were accessed by five out of eight community members to protect their livelihood. Community member J moved his banca into a vacant lot; member G relocated pigs to her personal property; member MG relocated her carabao to the barangay hall; member P placed large piles of debris dug out from the canal in her resort picnic area while waiting several days for the barangay to pick it up, and community member I spoke about roofs being detached from their kubos and placed along the foreshore area.

Bancas, pigs, carabao, debris removal and roofs are all related to livelihoods. Without space to transfer animals and objects from flooded areas community members would suffer economic loss, an important consideration for vulnerability. Of the spaces accessed, two were owned by community members, the barangay hall and foreshore area are public space and the vacant lot is privately owned but the community has full access (Field notes, 2019). The three examples below illustrate the role of space and culture in the Philippine experiences.

Example 1: The banca and the vacant lot

Many fishermen's bancas dock on the foreshore area, some of these areas are narrow and completely disappear when typhoons trigger storm surges, like the location in image 2. In these cases, fishermen resort to lugging their bancas further ashore into vacant lots adjacent to the coast. Fishermen cannot easily move their bancas into their communities as the alley ways that allow access to the beach are small and narrow prohibiting the movement of bancas through them. As such fishermen rely heavily on these vacant lots to protect their bancas during typhoons. In Typhoon Ompong, eight bancas were protected in the vacant lot as seen in image 3 (Community member J, 2019). Image 3 also shows the lack of wide beach access and the dense planning of the community.

Image 2. Bancas docked in narrow foreshore area

Image 3. Ariel view of development in Lingsat Barangay, bancas and vacant lot. Data source: GoogleEarth, 2019

Example 2: The kubo and the foreshore area

A *kubo* is a traditional bamboo and thatch semi-permanent structure. They dot the popular Urbiztondo beach and cater to tourists, offering surfing lessons and surfboard rentals, see image 4. The structure is built such that the thatched roof can be detached from the bamboo poles and removed for protection during inclement weather, image 5 illustrates this construction design. According to community member I, the detachment process takes ~ten-twenty people. During Typhoon Ompong community members removed several thatched roofs and relocated them deep in the foreshore area. As thatched roofs become soaked and weighted down by water the roofs become too heavy to remove and straps are placed over them and anchored to the ground (Field notes 2018). Having ample space in the foreshore area is necessary for storing roofs of kubos which directly translates into livelihood protection of the local community who cater to Urbiztondo's growing tourism sector. Recently, the community has collectively initiated a modification to the kubos to replace the thatched roofs with plywood roofs equipped with a similar detachment mechanism (see image 6); according to community member I this is to reduce the number of people needed to remove the roofs because plywood is lighter than thatch and absorbs less water (Field notes, 2018).

Image 4. Traditional beach kubo, Urbiztondo; image 5. Thatch roof enjoinment; image 6. Plywood bamboo enjoinment

Example 3: The Barangay hall and the animals

Community member G was not the only person to access the barangay hall to keep her evacuated animals safe during Typhoon Ompong. According to a barangay worker, more than twenty animals (carabao, goats and pigs) were evacuated by community members to the space immediately adjacent to the barangay hall. Community members also kept their vehicles in the barangay hall parking lot and a few evacuated persons took refuge in the barangay hall (Field notes, 2019). Figure 7 illustrates the topology of the barangay hall and its use during Typhoon Ompong, the solid yellow line delineates the physical barangay hall structure where people evacuated and sheltered and also where community member accessed services such as medical and other assistance, the dash red line shows the parking lot where vehicles were kept during the typhoon and the adjacent land indicated by the dotted green line is the location where animals were placed.

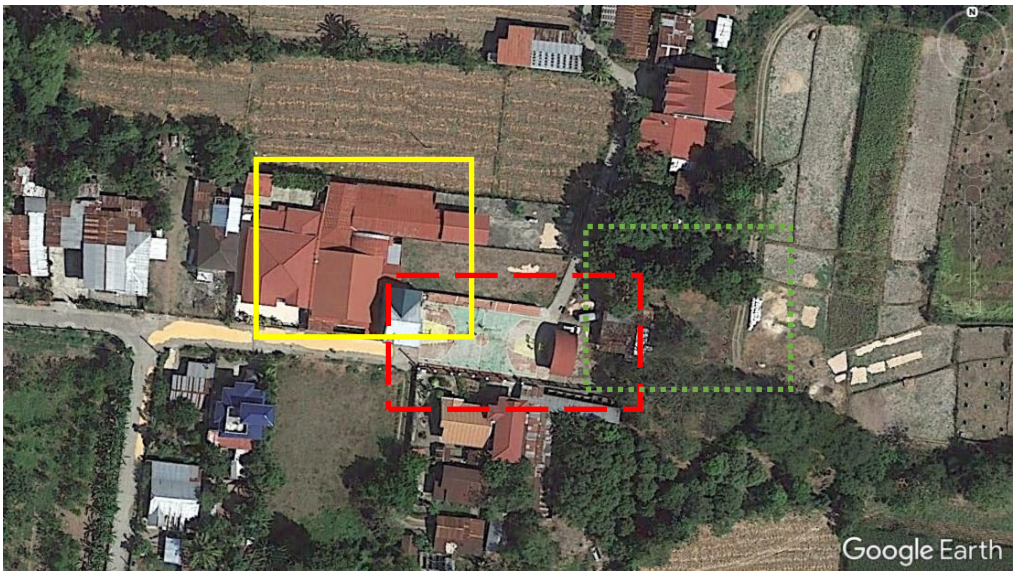

Figure 7. Topology of the barangay hall. Solid yellow line, physical barangay hall structure where people evacuated and sheltered; dashed red line, vehicles parked in parking lot; dotted green line, animals evacuation area. Data source: GoogleEarth, 2019)

The term barangay comes from the Malay word for boat and is known today as the smallest administrative unit in the Philippines. However, in pre-colonial times the term referred to a social unit and identity that gathered people into a cohesive group, through shared rituals and cultural practices (Bernal, 1967). The barangay hall is a physical community space that offers services and trust networks that were mentioned in 50% of Philippine community member experiences. Both the physicality and the immateriality encompassed in the barangay hall were factors that reduced community vulnerability during Typhoon Ompong.

There is no comparative equivalent to the barangay hall in the Mexican experience, however space is observed to be heavily influenced by disaster in a different way. Three of the seven community experiences mentioned semi-walls—two constructed after hurricane Jova and one before. After hearing about the semi-wall I began to observe them throughout the community of Melaque and was told that it was a popular post-flood construction technique throughout the region (field notes, 2018). In most cases the semi-wall is constructed at the base of a doorway to block water from entering the house as shown in image 7. In some cases, the height of the wall is so high it transforms the door into a window, as demonstrated in image 1a—even with low semi-walls, mobility with entering and exiting is reduced.

Image 7. Typical post-flood semi-wall construction in Melaque, Mexico

Viewing themes of *livelihood*, *animals* and *structural modifications* through a socio-spatial framing expose culturally distinct practices. In Mexico, community members, deeply influenced by their material loss, transformed their immediate surroundings to reduce future damages, whereas the Philippine experiences demonstrate a more passive reaction to hydro-meteorological disasters that encompasses wider movement and non-structural practices, the latter of which could be influenced by traditional Philippine architecture. Traditionally Filipino homes are two floors, the first level being stone or concrete and the second made of wood—two community members interviewed have such homes, see image 8. During a conversation with a barangay captain she mentioned that a preparedness strategy for her community was moving household items to the second floor during floods (Field notes, May 2019). None of the seven community members interviewed in Melaque, Mexico had two storey homes, all were single storey.

Image 8. Traditional Philippine house

This physical cultural artefact could reflect why the community members' experiences in the Philippines did not include material loss, had a greater spatial radius and a more passive response compared to the Mexican experiences. This manifestation fits into what Bankoff (2015), who has worked extensively in the Philippines, terms 'disaster culture', which is the result of such a continuous threat and occurrence of hazard that it becomes imbedded in the material culture and social consciousness of a nation.

Conclusion

David Harvey does not want geography to be relegated to the stuff of facts but instead used to theorize space and place for social justice gains (in Castree 2004). In linking the commonalities and dissimilarities of the meso-and macro-assemblage themes, elements of vulnerability and resiliency are exposed in the local experience that lend to understandings about vulnerability at a social scale (DeLanda, 2006, p. 17).

First, there are elements of vulnerability that operate similarly across cultural gradients, such as roof condition, trees and assistance of people. Strong roofs, maintenance of tree canopies and the assistance of people, irrespective of material cultural, will reduce individual and community vulnerability, therefore these elements should be recognized as a global standard. Secondly, people are rarely static in disaster. Their movements depend less on age, income level and education and more on physical ability and their access to space. Physical ability and access to space are positively related, for example, if a community has ample physically able persons but lacks access to space, then vulnerability is higher than if the community has both ample access to space and able-bodied people. Thirdly, access to space is entangled in historical and cultural

materiality. This element can be as innocuous as accessing a second floor in a home or a more intricate situation where social protocols and social capital are requirements for access. As such, access to space is highly culturally dependent and cannot be applied outside a local context. This means that standard procedures to map at national and regional scales would be insufficient to capture this element as place is always local. And fourthly, space undergoes a transformation during a disaster and is irrevocably transformed thereafter. This includes immaterial transformation, like changes to or new emotionality of spaces or increase risk perception, and material transformation, like the addition of semi-walls to spaces or modifications of kubo roofs. The changes to space also mean that risk maps need to be updated to account for these transformations.

A paradigm shift is needed in the approach to assess and map disaster risk. A more fulsome consideration of scale and culture is crucial in this transformation. However, the limitation of risk maps and assessments need to be realized and clearly articulated at all levels of society. As such, risk assessments and maps as policy and planning instruments should never be used in isolation but as a component of socially engaged risk reduction.

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